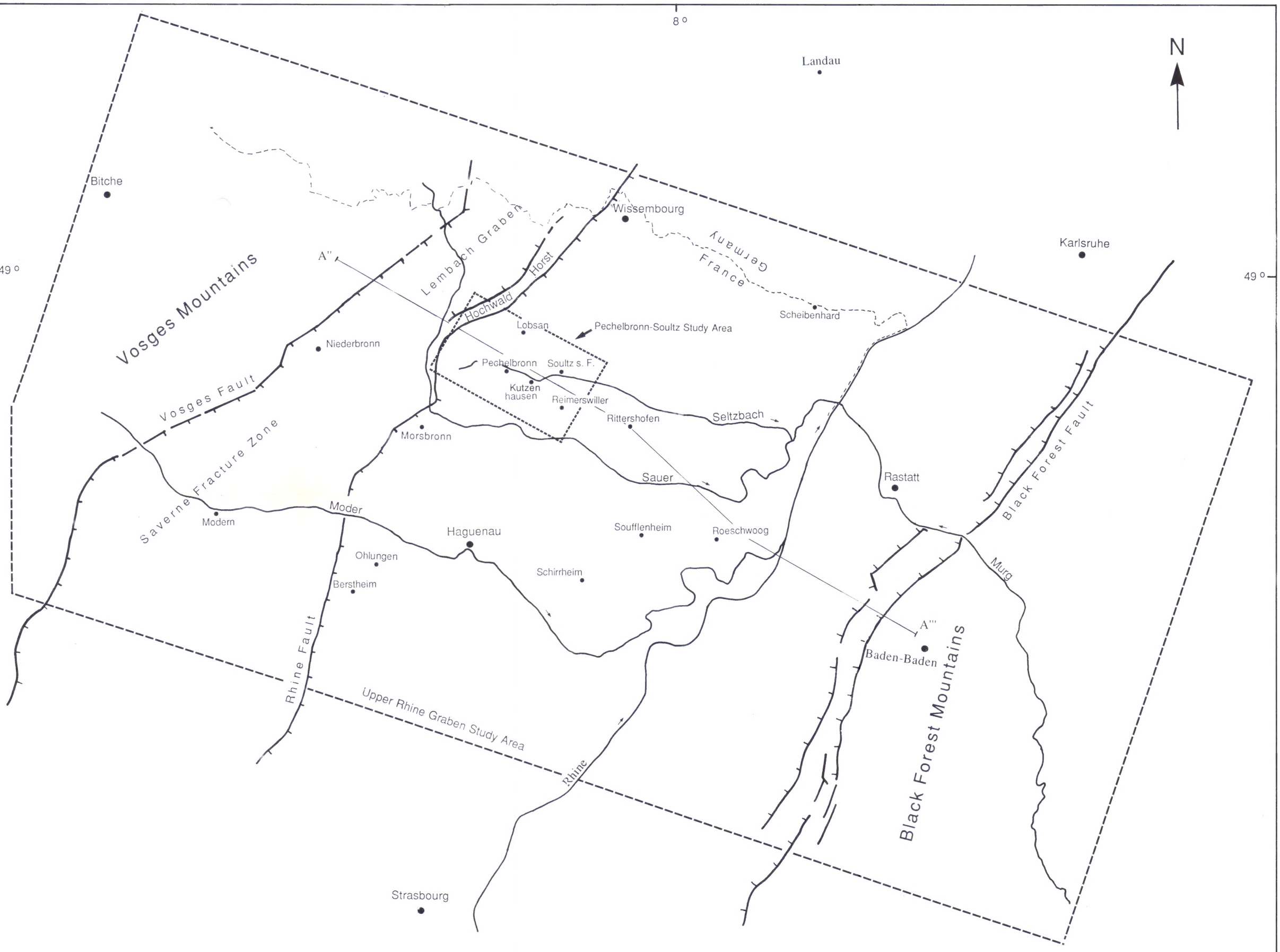


Figure 67

Location of the Pechelbronn-Soultz and Upper Rhine Graben study area, relevant towns, rivers and geologic - tectonic features

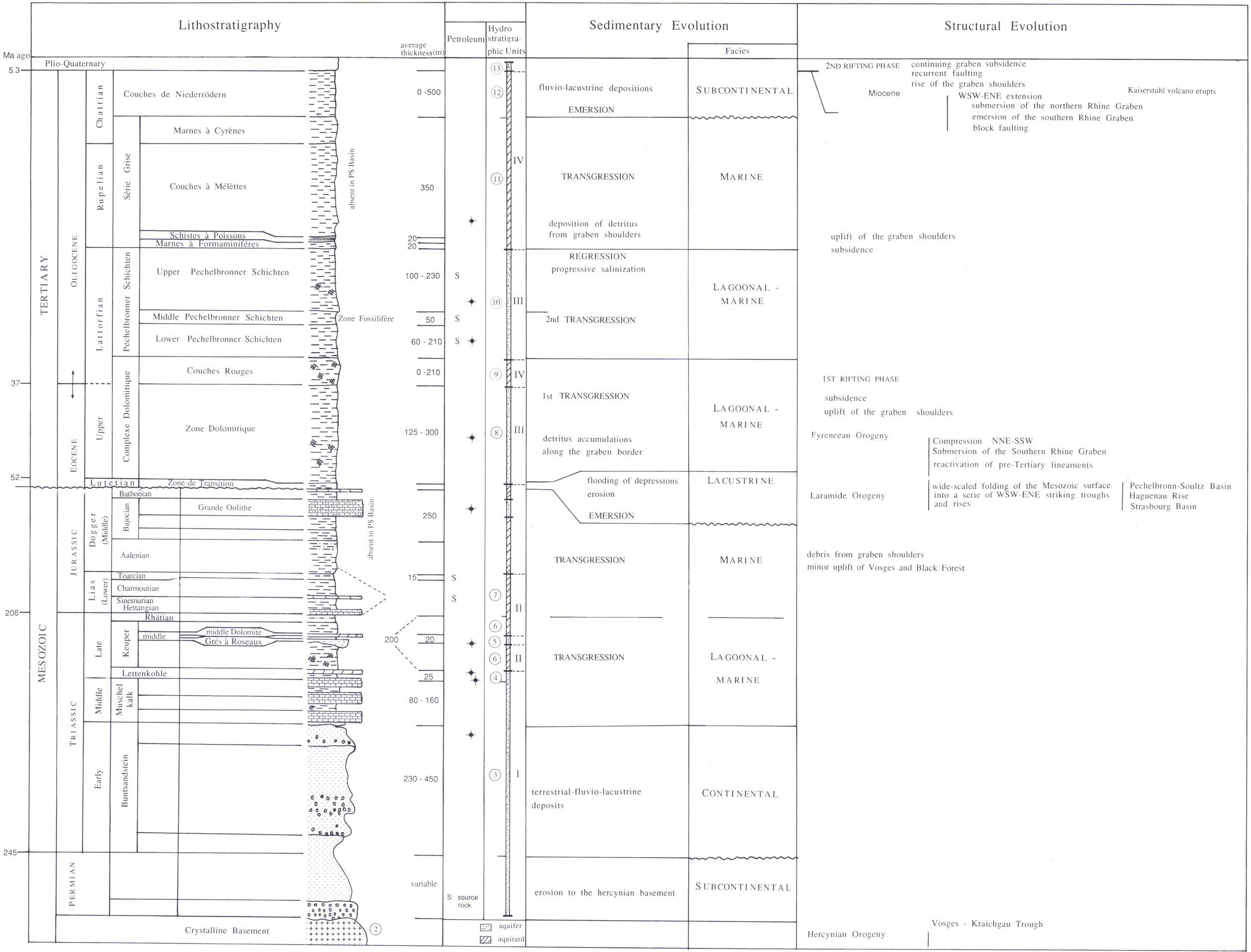


Figure 68 Lithostratigraphy, petroleum geology, hydrostratigraphy and geohistory of the study area

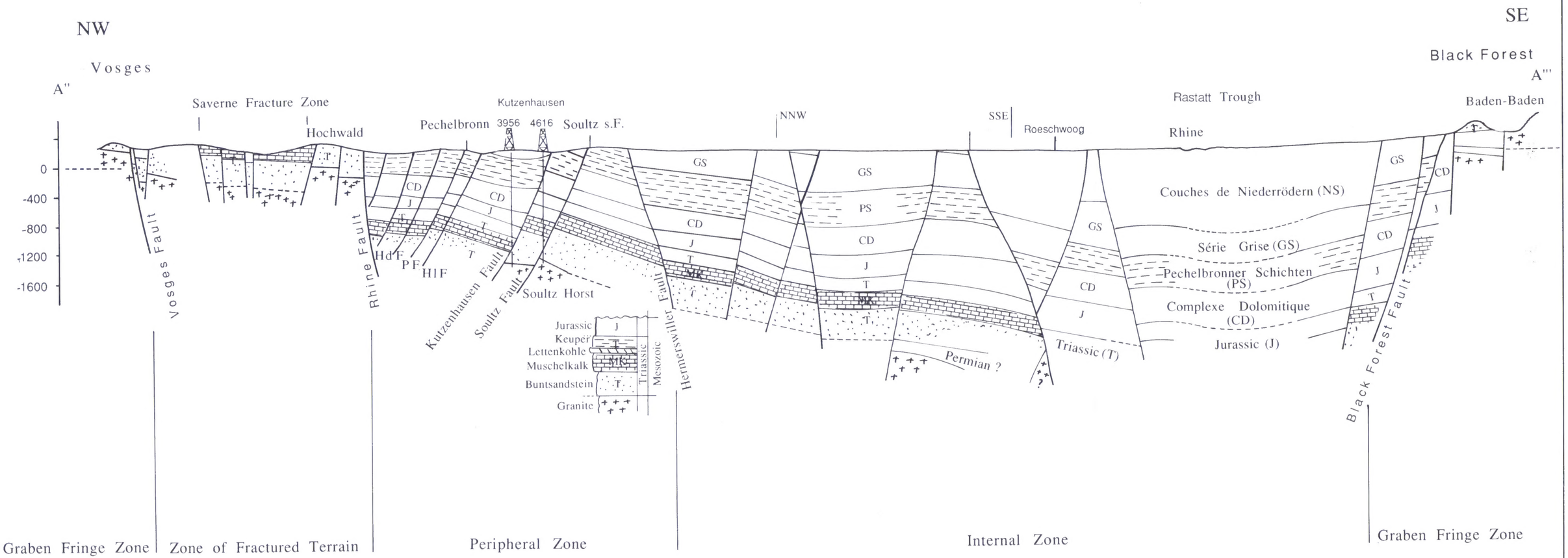


Figure 69 Regional simplified cross-section (A''-A''') of the Upper Rhine Graben study area (data sources: SAEM, PREPA well reports, Sittler '85) and definition of strucutral zones and elements

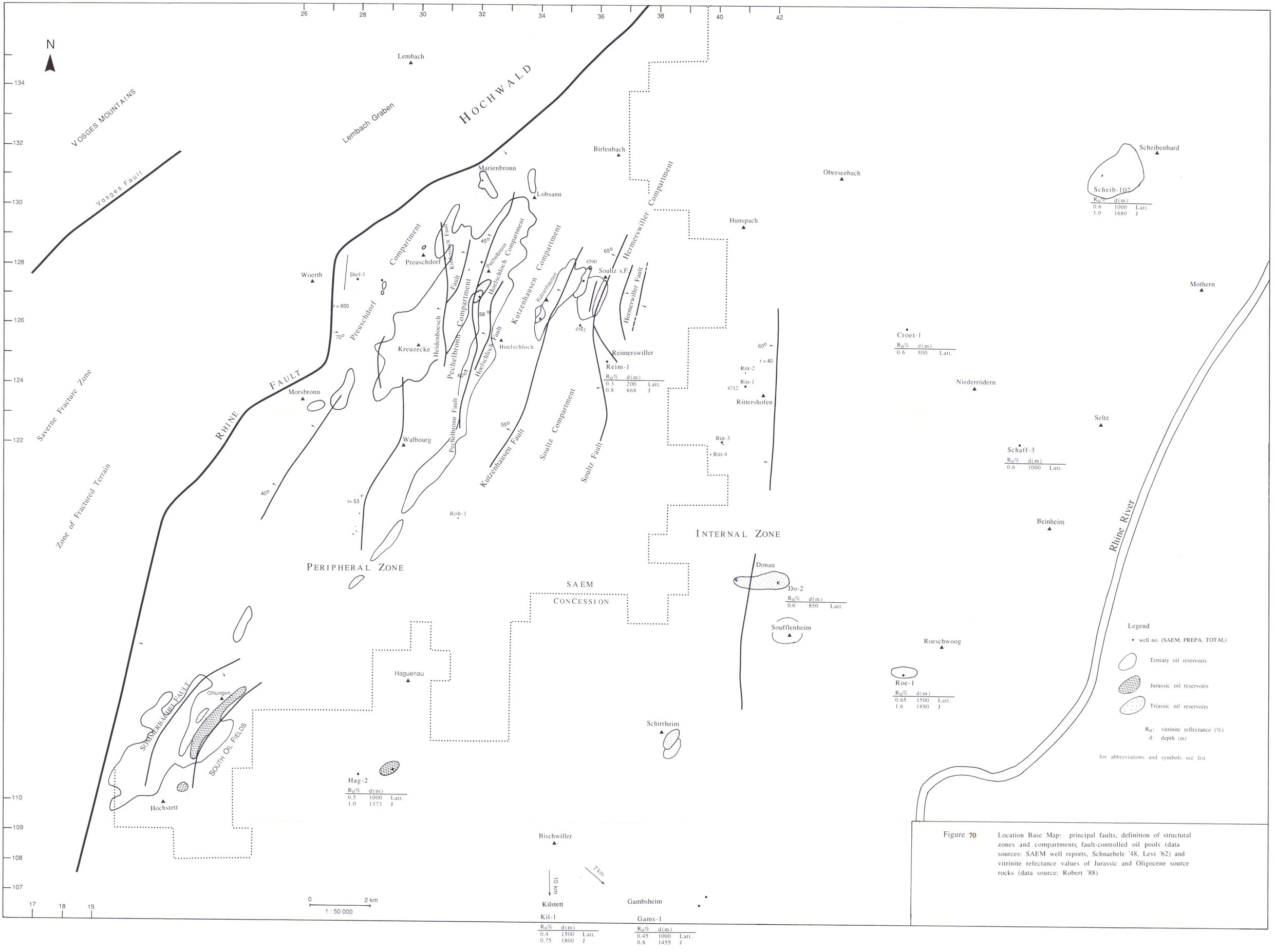


Figure 70 Location Base Map: principal faults, definition of structural zones and compartments, fault-controlled oil pools (data sources: SAEM well reports, Schnaebele '48, Levi '62) and vitrinite refectance values of Jurassic and Oligocene source rocks (data source: Robert '88)

Figure 71 Complex structure contour map of top of Muschelkalk (HSU 3), principal faults, structural compartments, producing oil wells, formation water salinity distribution and other hydrogeological phenomena (see also Figure ; data sources: SAEM well reports, BGR)

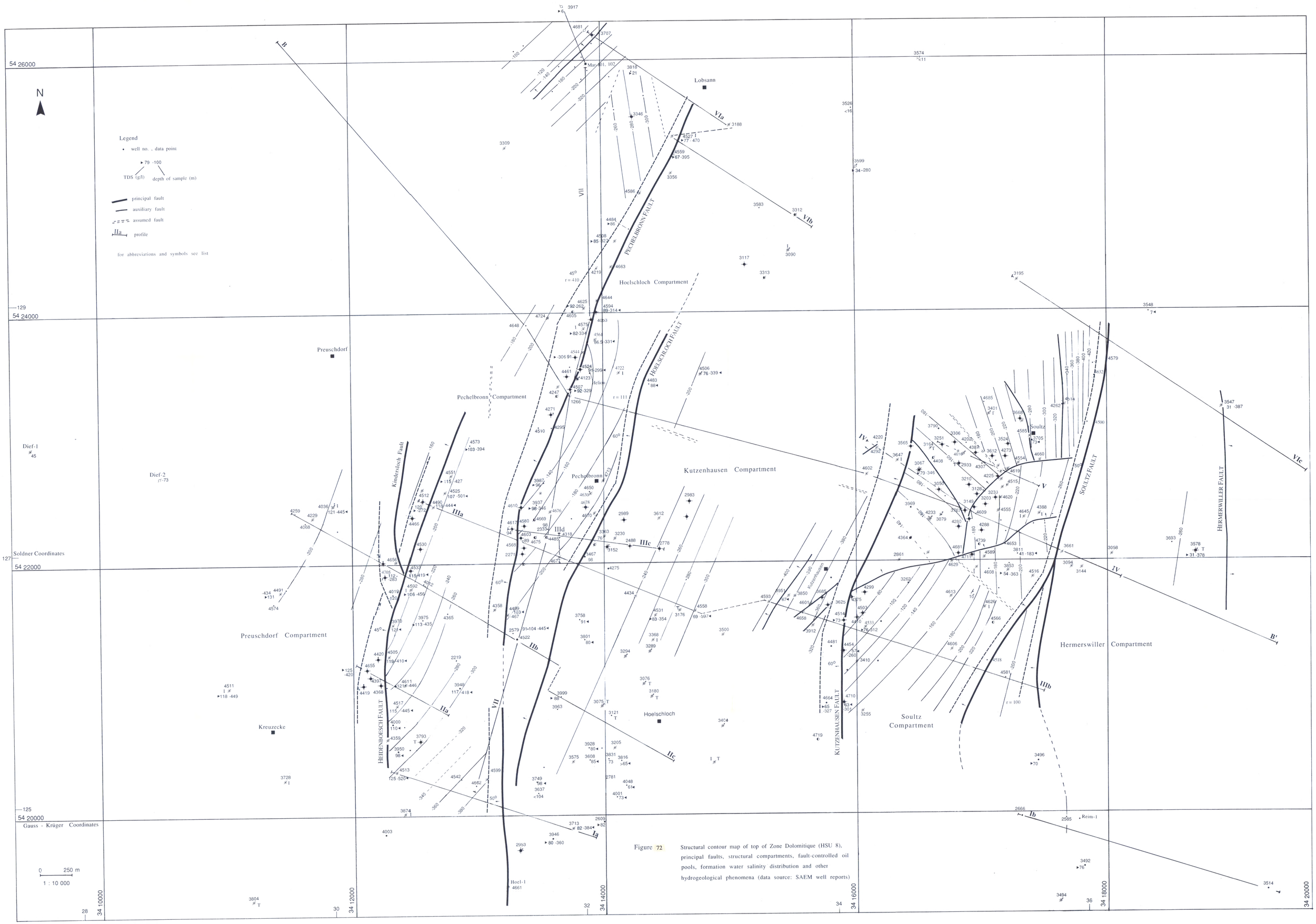


Figure 72 Structural contour map of top of Zone Dolomitique (HSU 8), principal faults, structural compartments, fault-controlled oil pools, formation water salinity distribution and other hydrogeological phenomena (data source: SAEM well reports)

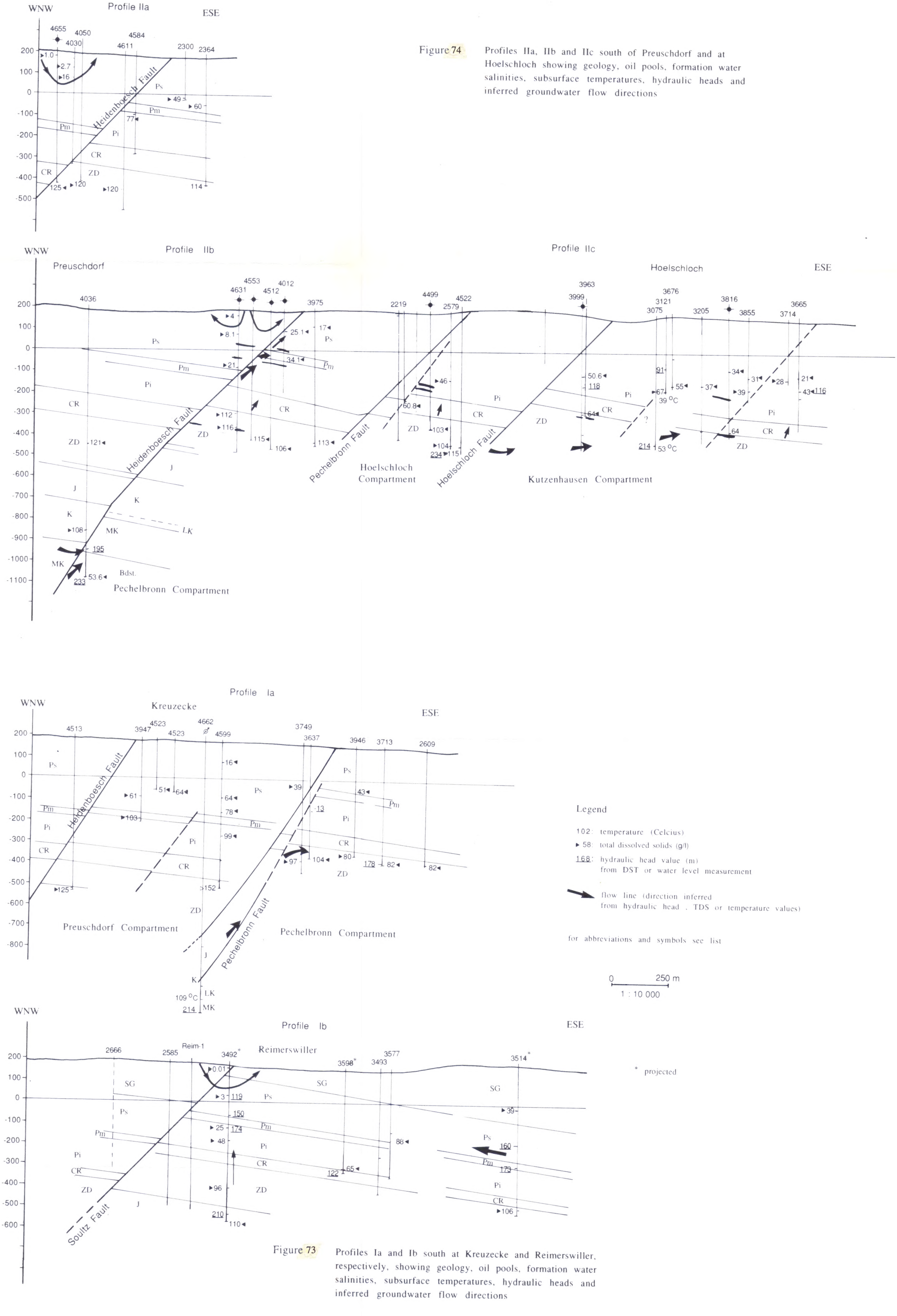
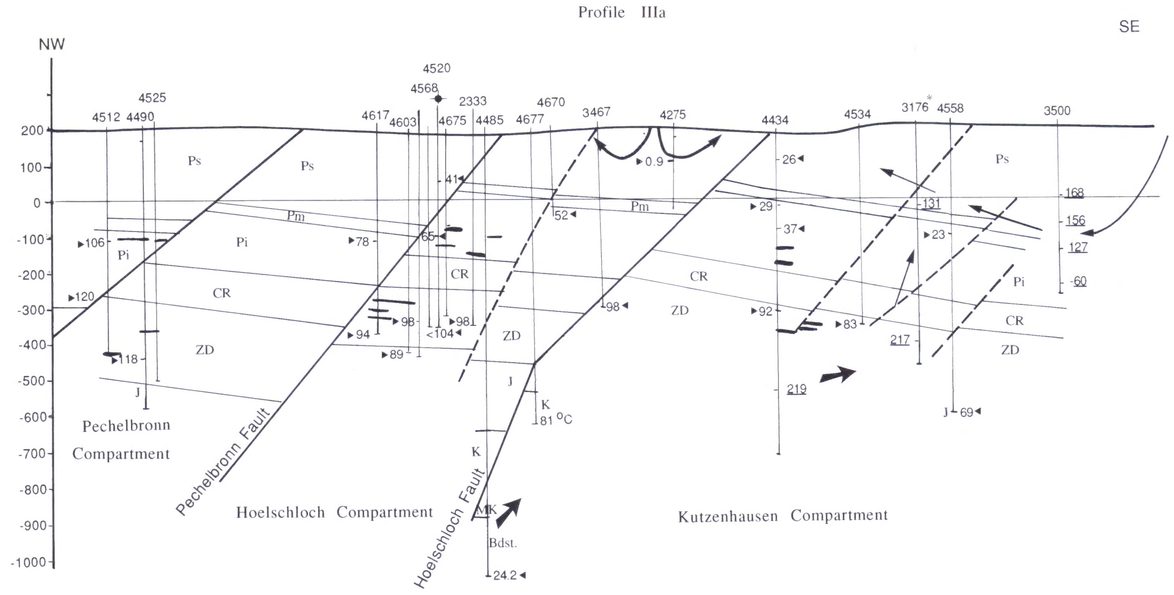
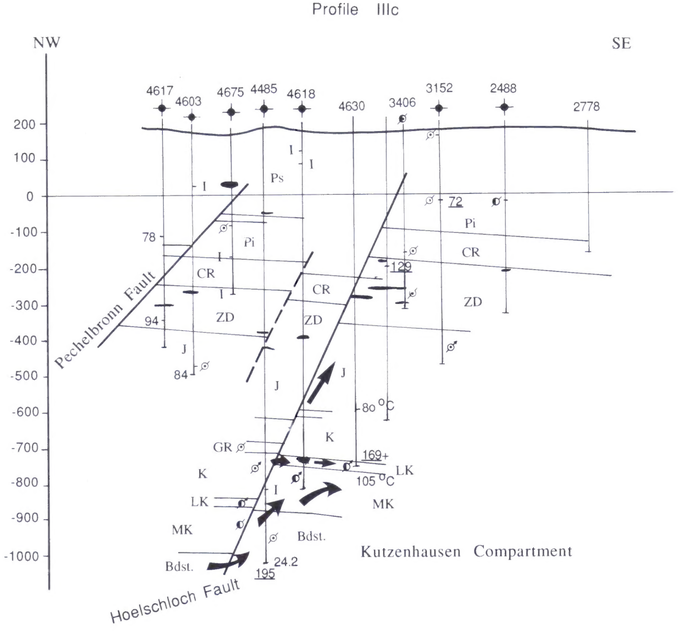
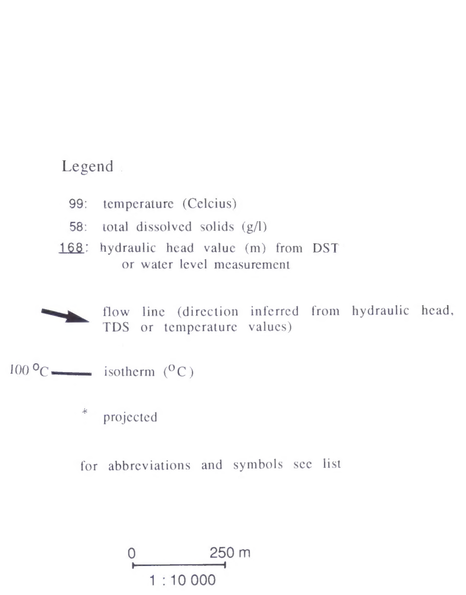


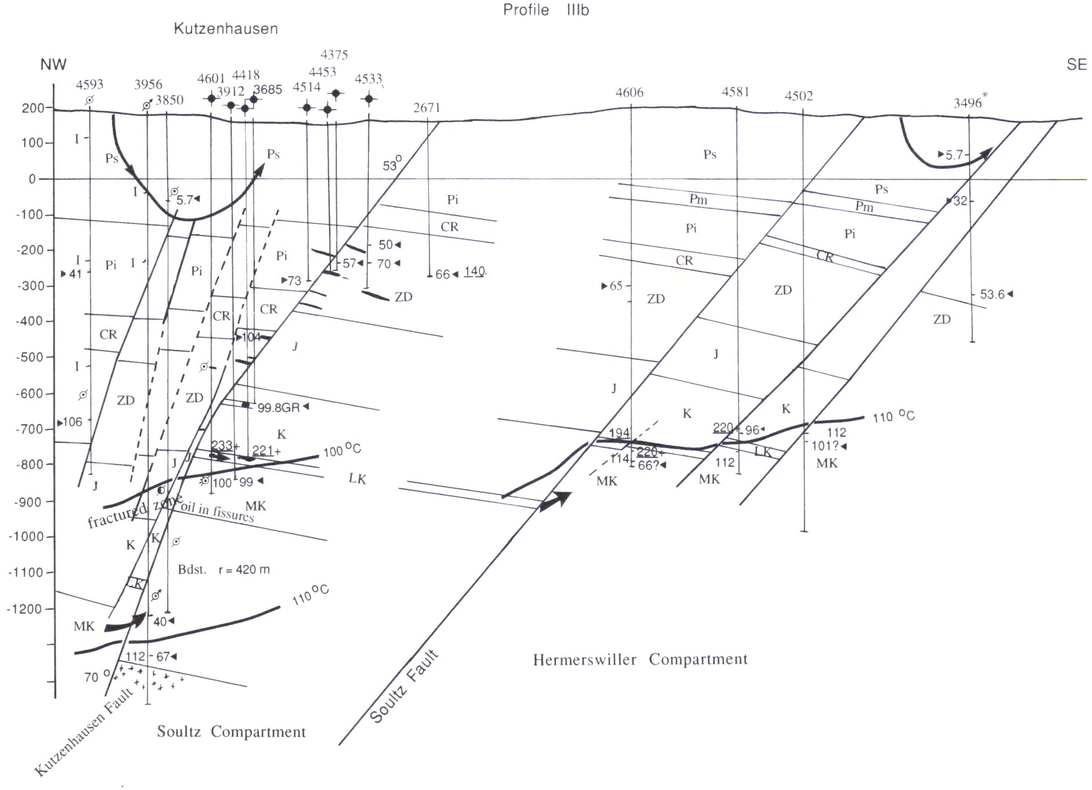
Figure 74 Profiles IIa, IIb and IIc south of Preuschdorf and at Hoelschloch showing geology, oil pools, formation water salinities, subsurface temperatures, hydraulic heads and inferred groundwater flow directions

Figure 73 Profiles Ia and Ib south at Kreuzecke and Reimerswiller, respectively, showing geology, oil pools, formation water salinities, subsurface temperatures, hydraulic heads and inferred groundwater flow directions









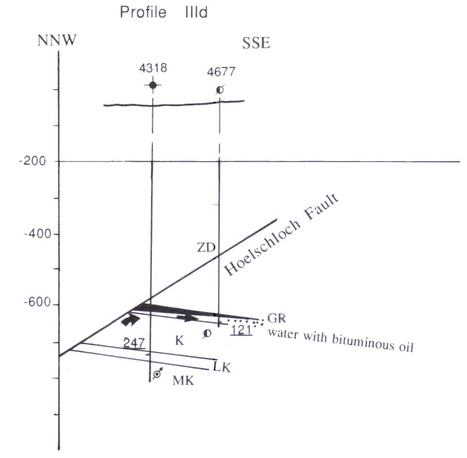


Figure 75 Profiles IIIa, IIIb, IIIc, IIId south of Pechelbronn and near Kutzenhausen showing geology, oil pools, formation water salinities, subsurface temperatures, hydraulic heads and inferred groundwater flow directions

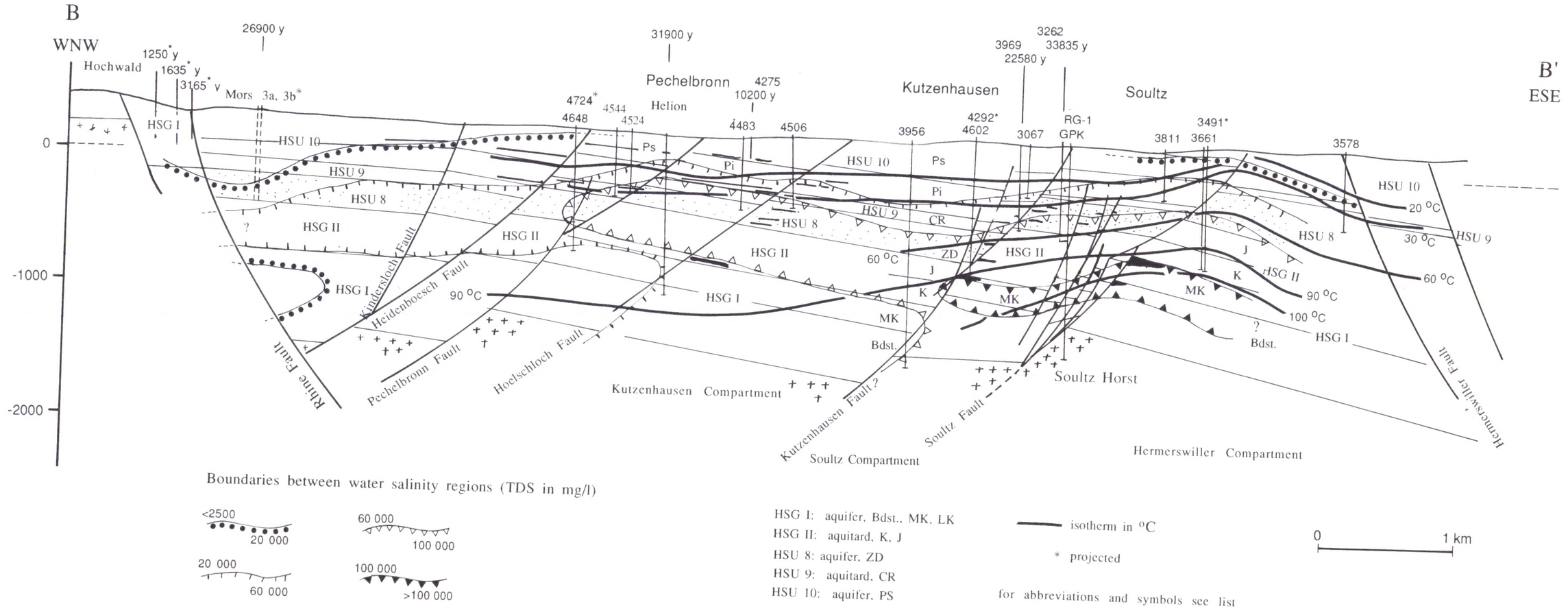


Figure 76 Profile B-B': General increase in salinity and ^{14}C age of formation waters and subsurface temperatures towards the Kutzenhausen-Soultz discharge area with groundwater flow direction, modified by the channelling-effect of fault zones in the Pechelbronn-Soultz Basin; section also shows anoverview of Tertiary and Triassic oil pools

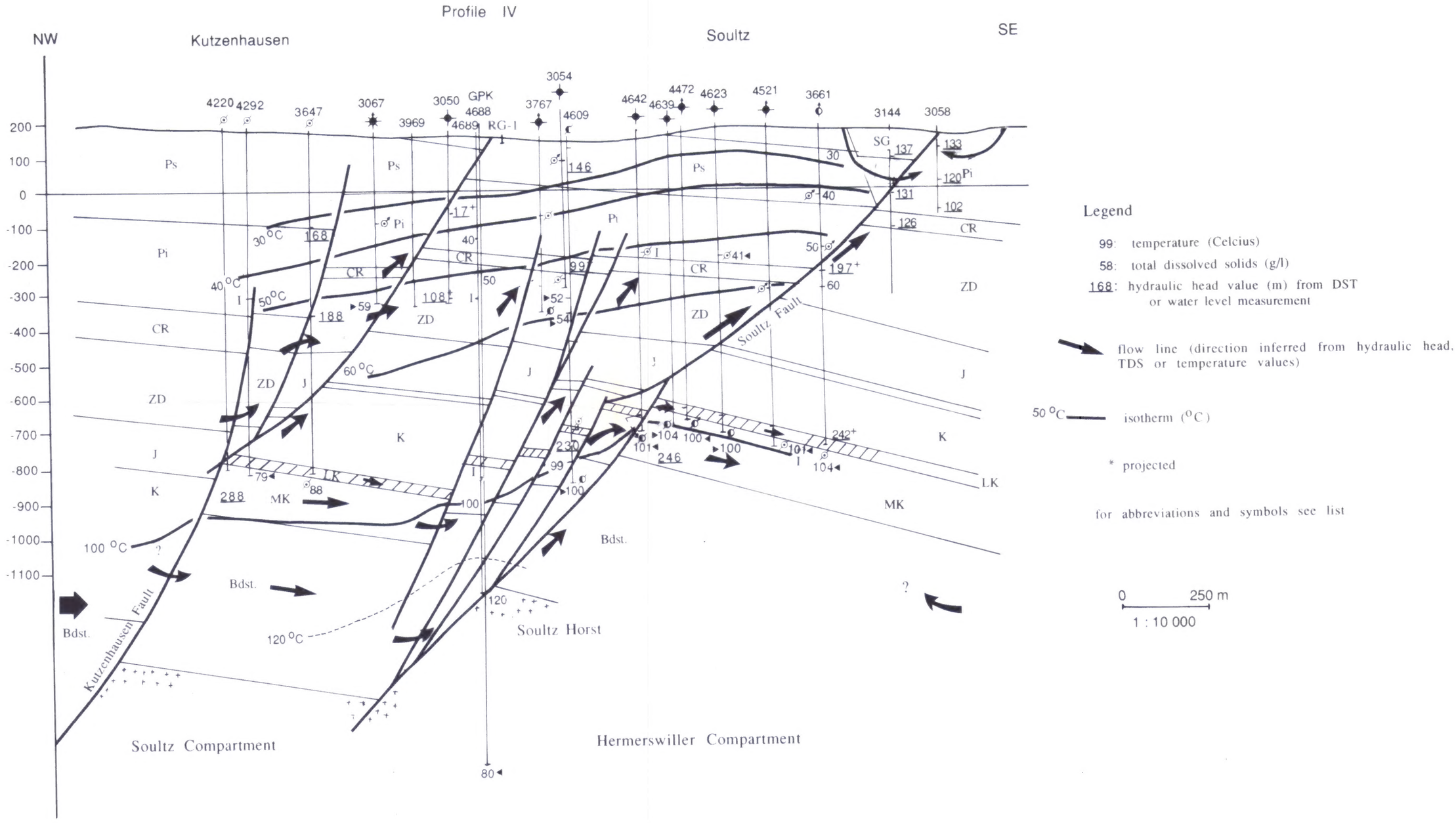


Figure 77 Profile IV at Kutzenhausen and Soultz showing a complex geology, oil pools, formation water salinities, subsurface temperatures, isotherms, hydraulic heads and inferred groundwater flow directions

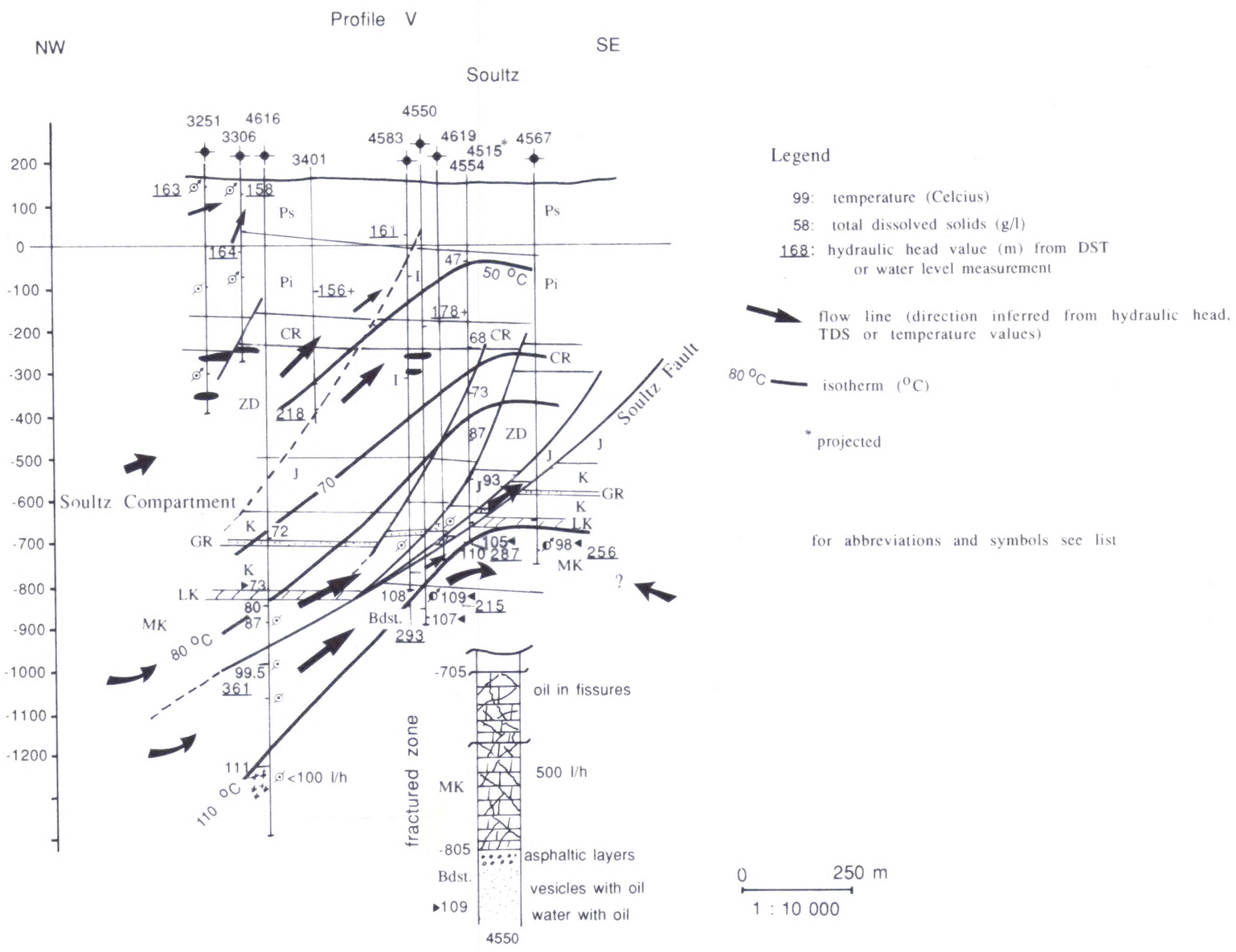


Figure 78 Profile V at Soultz showing a complex geology, oil pools, formation water salinities, subsurface temperatures, isotherms, hydraulic heads and inferred groundwater flow directions

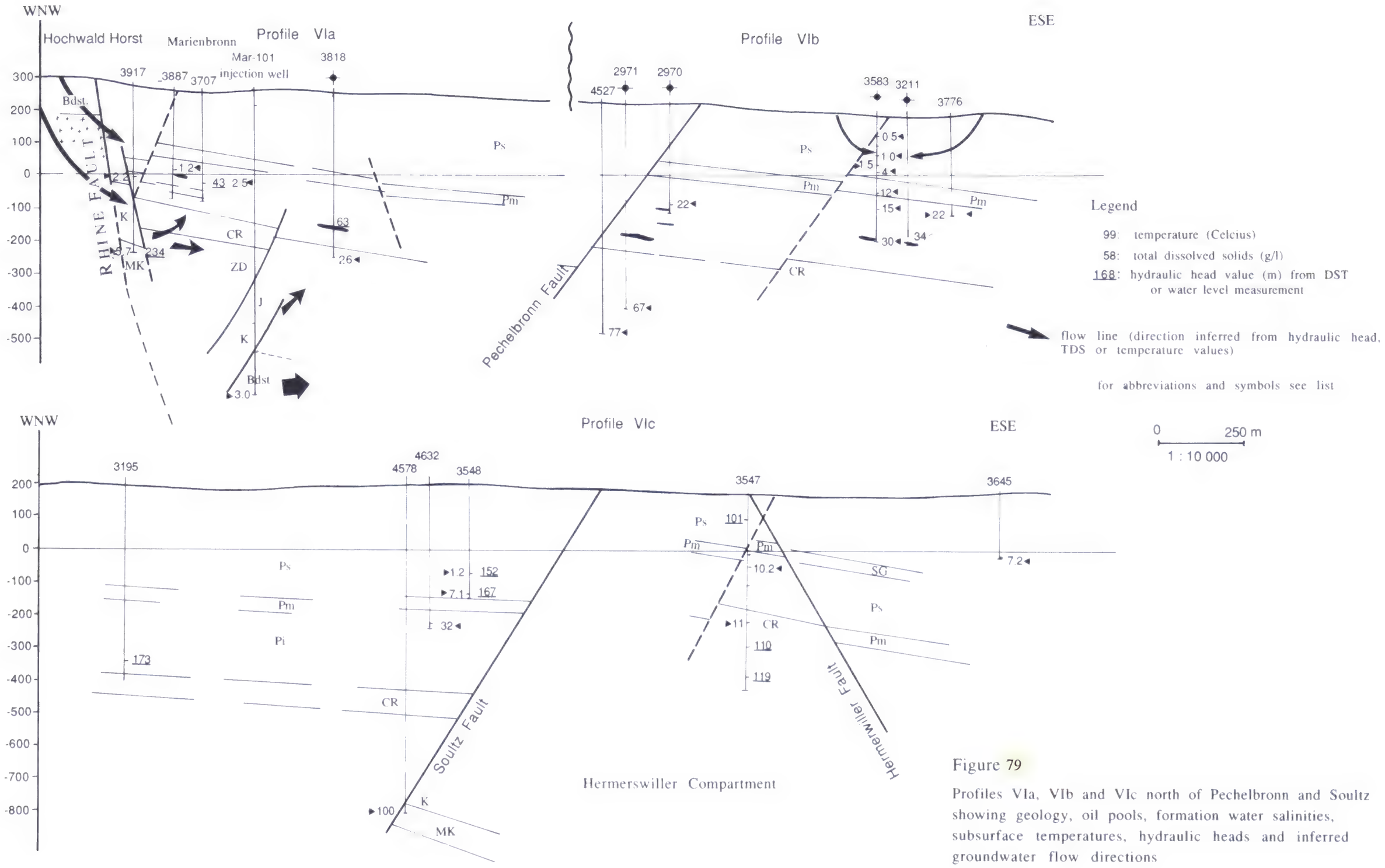


Figure 79

Profiles VIa, VIb and VIc north of Pechelbronn and Soultz showing geology, oil pools, formation water salinities, subsurface temperatures, hydraulic heads and inferred groundwater flow directions

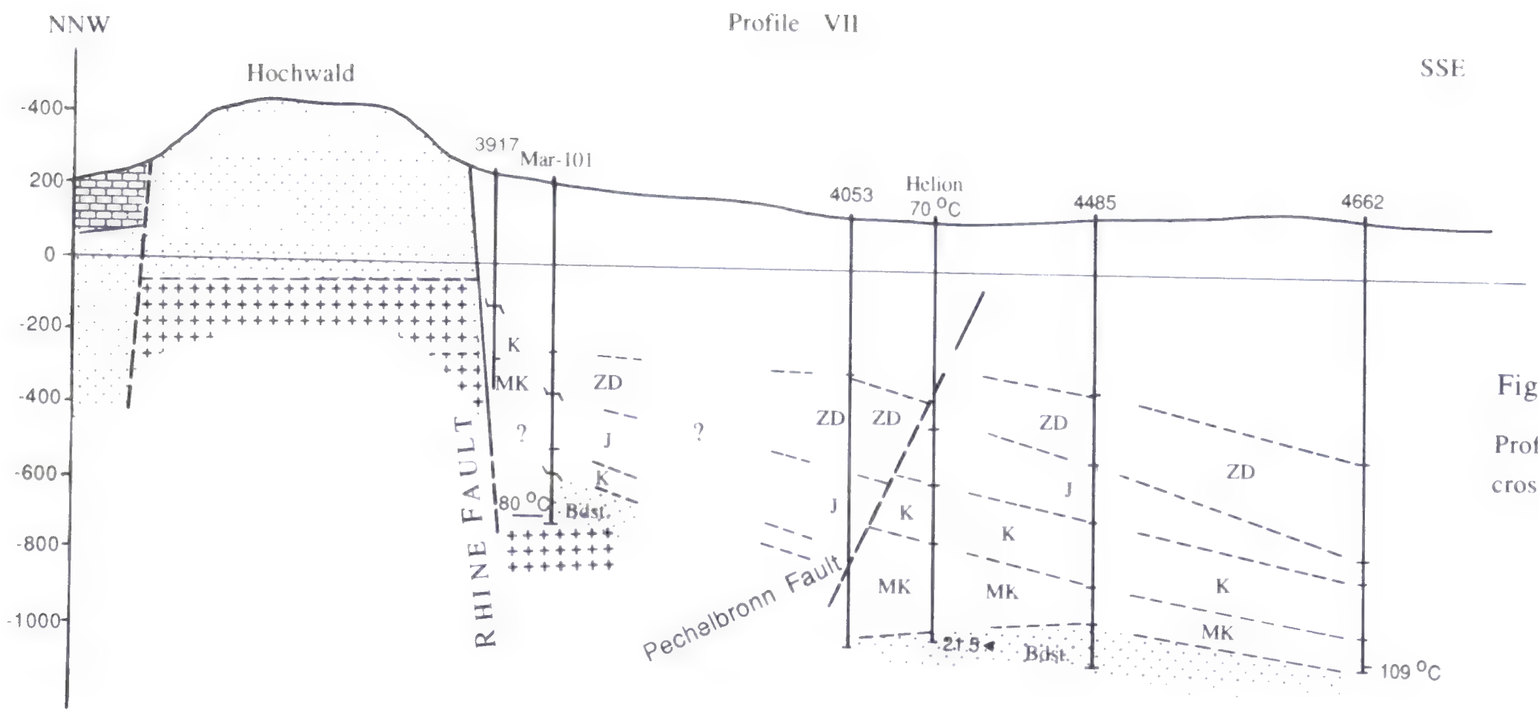


Figure 80

Profile VII shows a schematized NNW-SSE cross-section of the Pechelbronn-Soultz Basin

for abbreviations and symbols see list

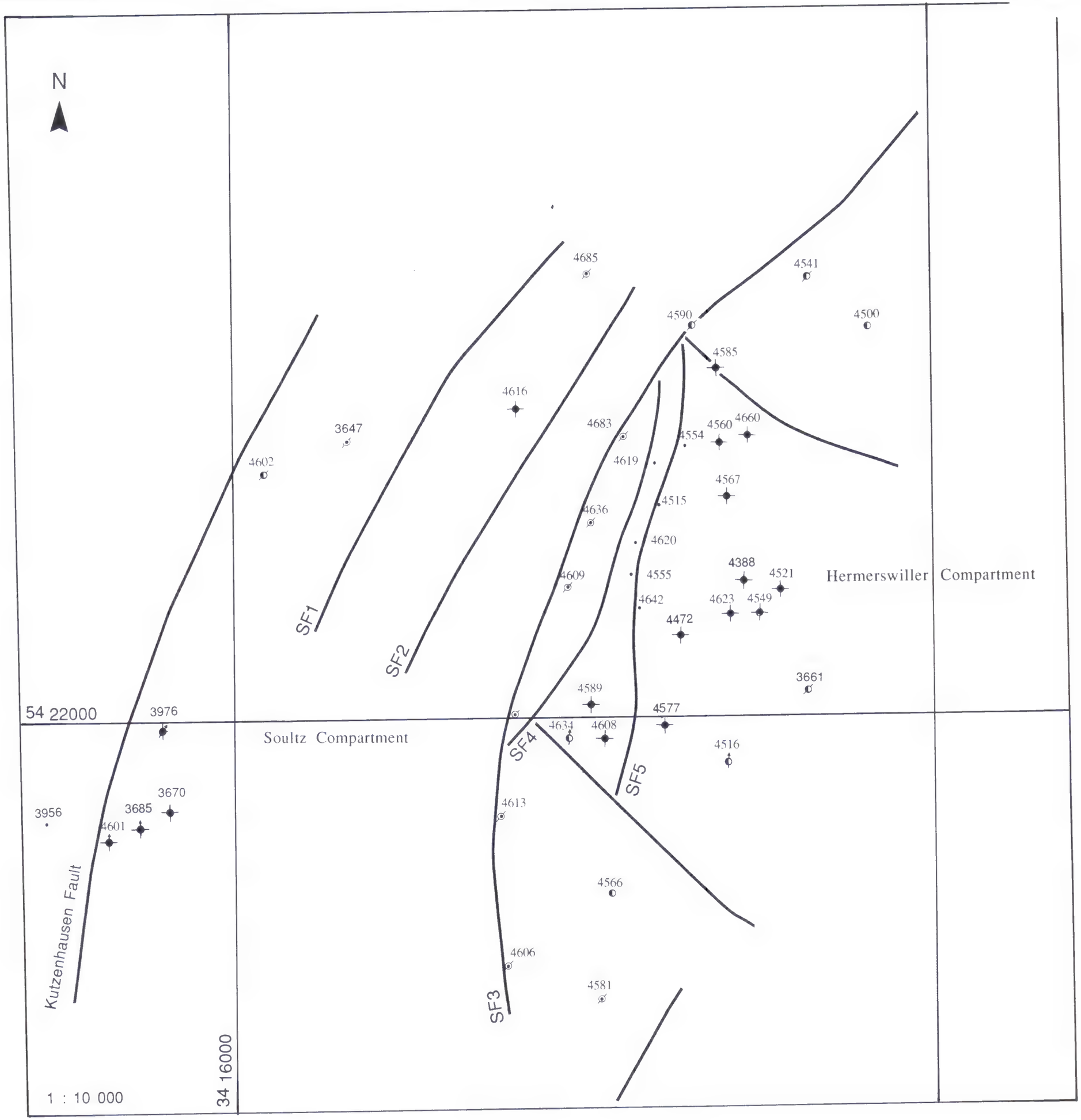
Legend

- well no. (SAEM, PREPA, TOTAL)

for abbreviations and symbols see list

Figure 81

The Lettenkohle is productive in the up-dip section of the formation in the footwall of the Kutzenhausen and Soultz Faults



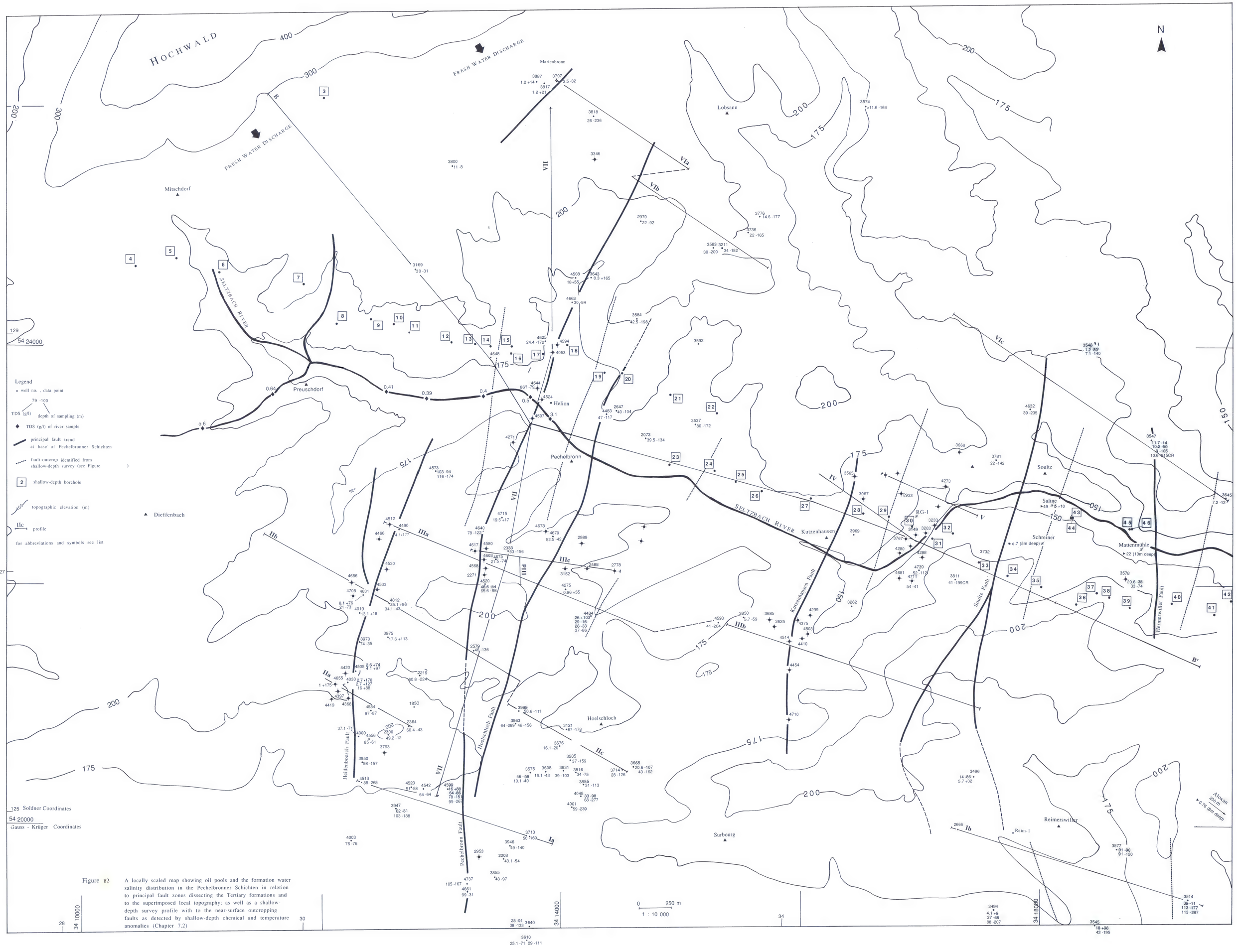


Figure 82 A locally scaled map showing oil pools and the formation water salinity distribution in the Pechelbronner Schichten in relation to principal fault zones dissecting the Tertiary formations and to the superimposed local topography; as well as a shallow-depth survey profile with to the near-surface outcropping faults as detected by shallow-depth chemical and temperature anomalies (Chapter 7.2)

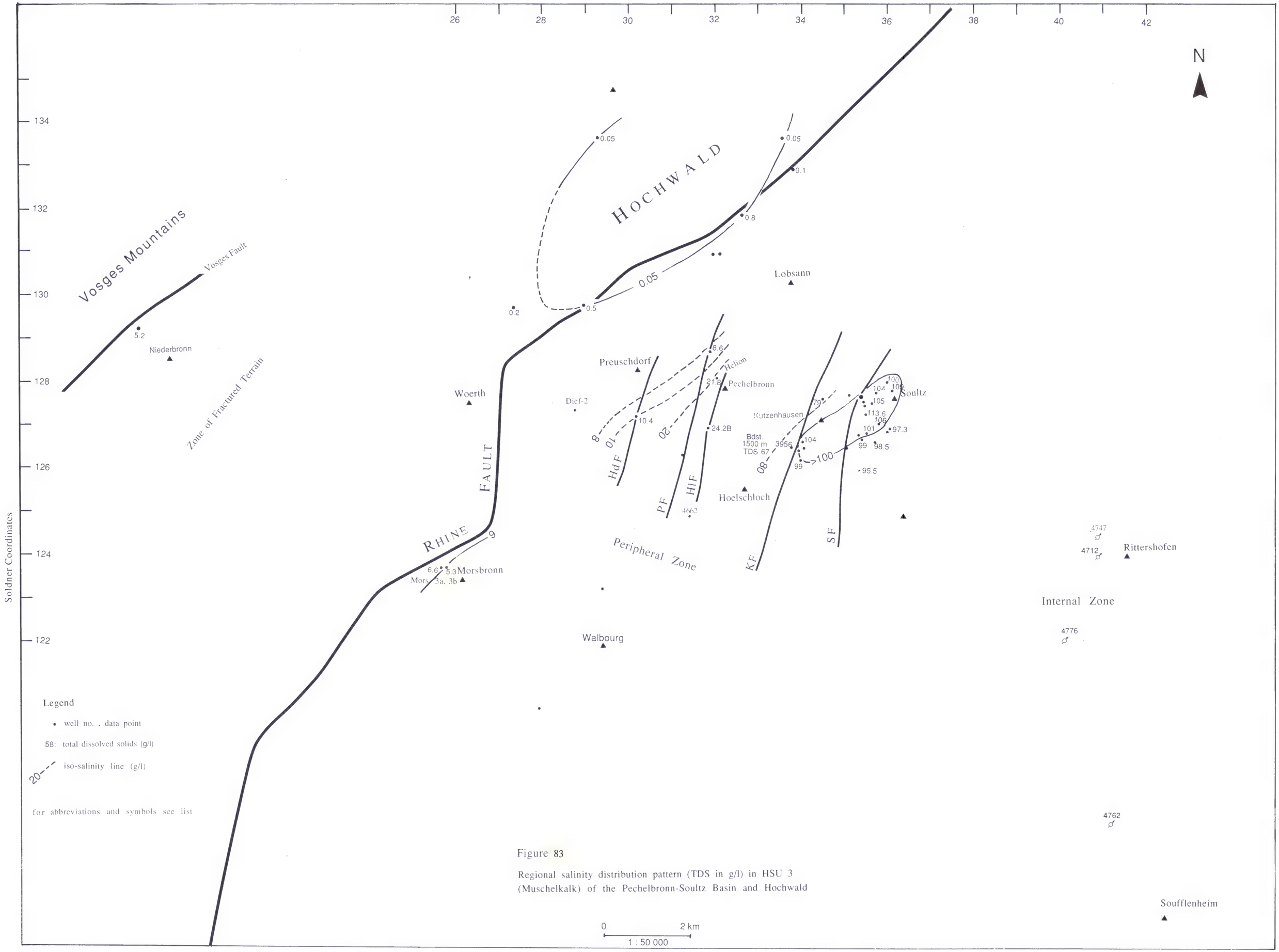
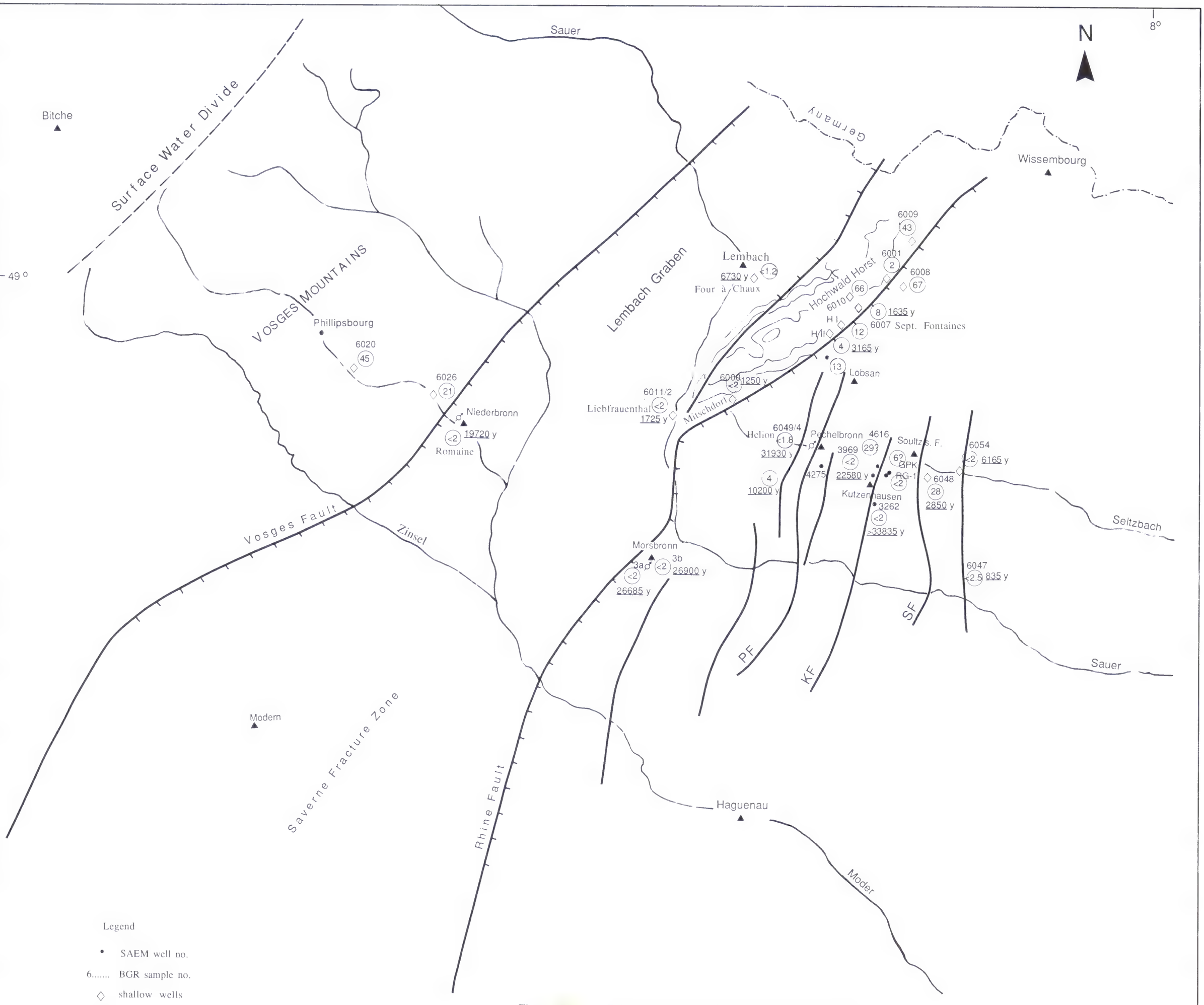


Figure 83

Regional salinity distribution pattern (TDS in g/l) in HSU 3 (Muschelkalk) of the Pechelbronn-Soultz Basin and Hochwald



Legend

- • SAEM well no.
- 6..... BGR sample no.
- ◇ shallow wells
- (4) tritium content (TU)
- 33835 y uncorrected ^{14}C age (years)

for abbreviations and symbols see list

Figure 84 Tritium content and uncorrected, conventional ^{14}C age of deep and shallow formation waters in the Vosges, Hochwald and Pechelbronn-Soultz Basin

1 : 100 000

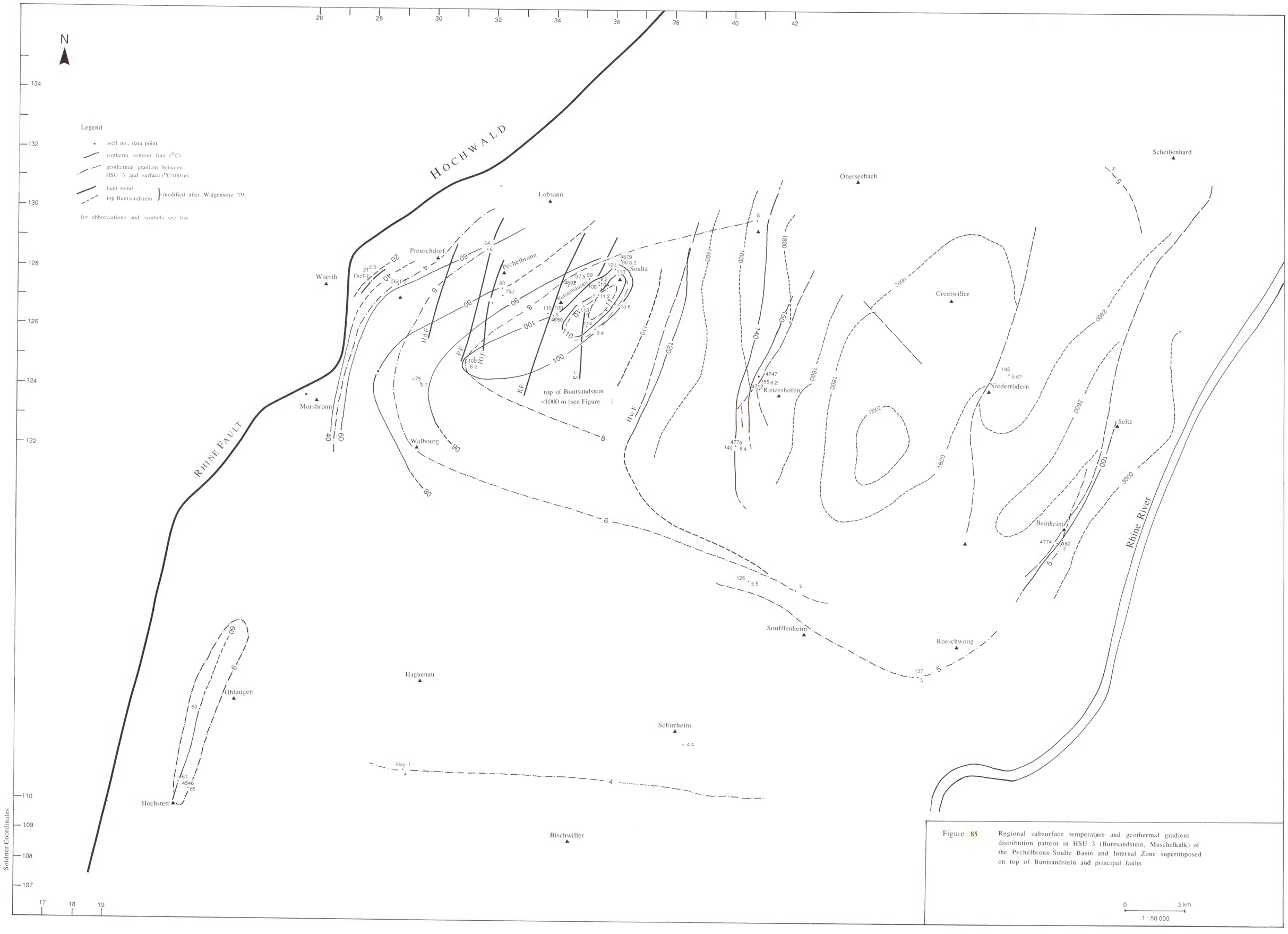


Figure 85 Regional subsurface temperature and geothermal gradient distribution pattern in HSU 3 (Buntsandstein, Muschelkalk) of the Pechelbronn-Soultz Basin and Internal Zone superimposed on top of Buntsandstein and principal faults

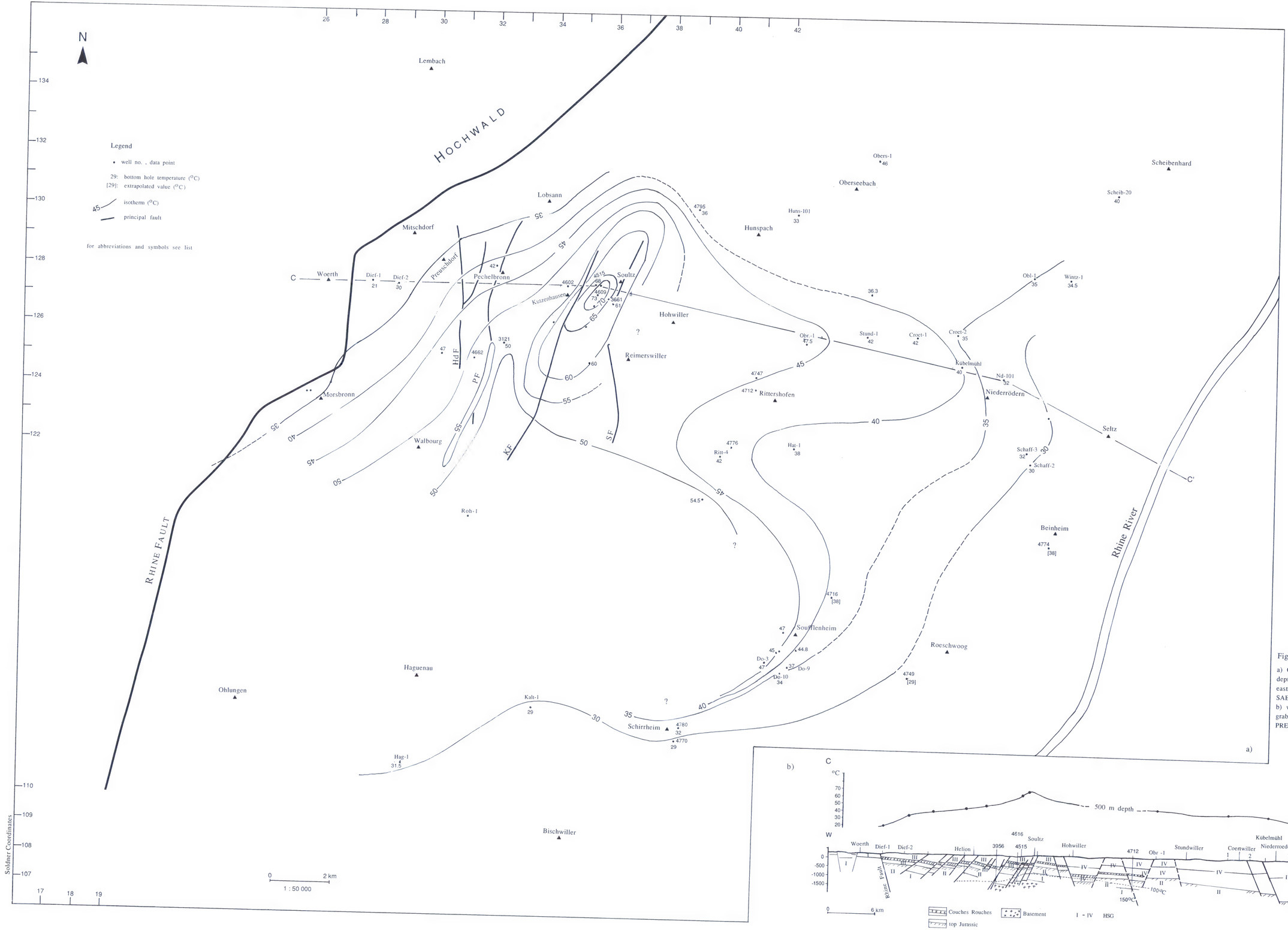


Figure 86 a,b

a) Contoured map of subsurface temperatures at about -500 m depth showing an increase in temperature from the west and east towards the Kutzenhausen-Soultz region (data sources: SAEM, PREPA well reports, Hass and Hoffmann '29);
b) variation of temperature at -500 m depths shown across the graben on a simplified cross-section C-C' (data sources: SAEM, PREPA well data, Sittler '67)

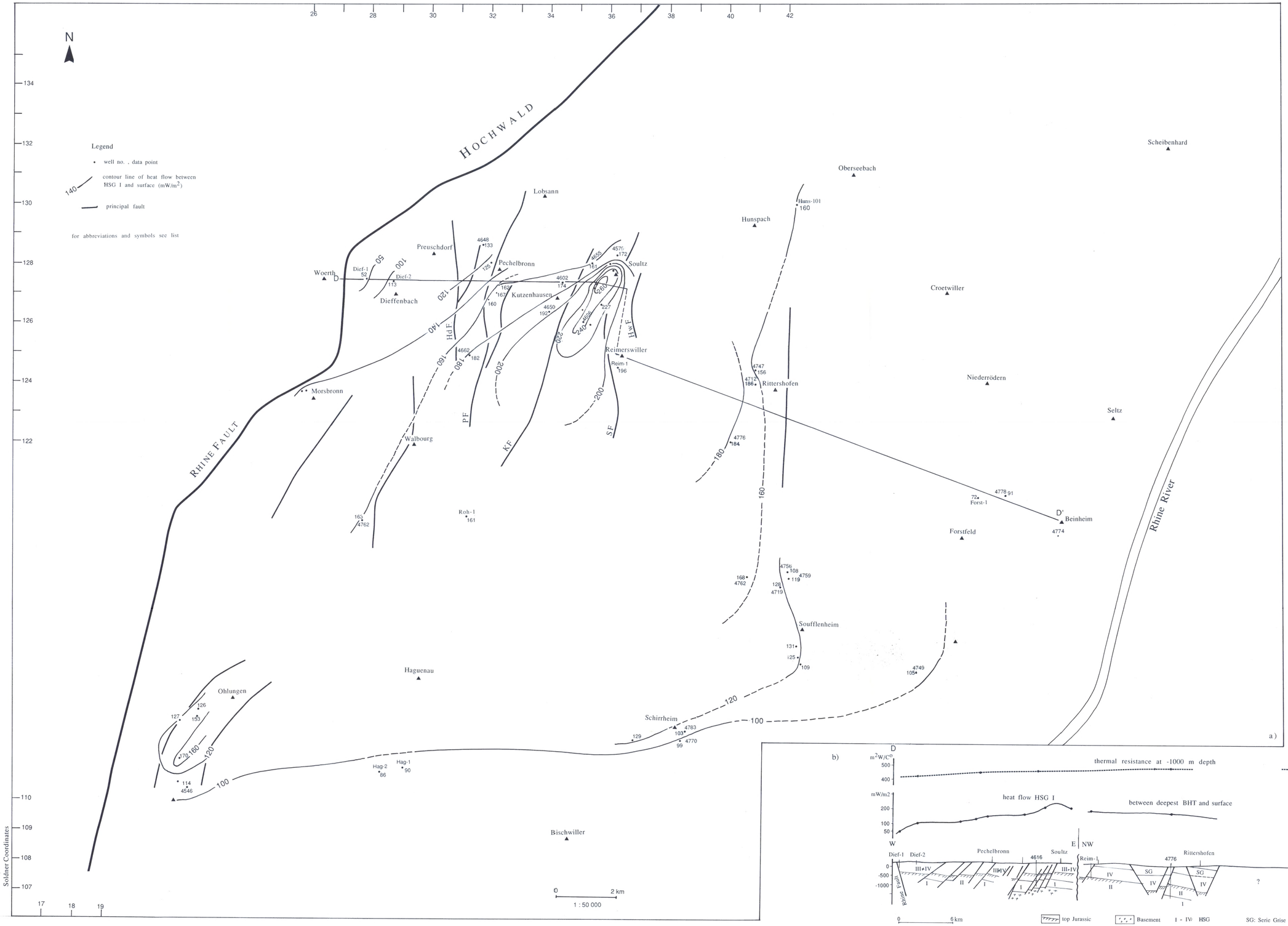


Figure 87a,b

a) Contoured regional map of heat flow in interval between surface and depth of HSG I; wells marked are those with deepest BHT taken mainly in Buntsandstein and Muschelkalk; b) Insignificant variation of cumulative thermal resistance to -1000 m depth, and significant variation of heat flow in HSG I with a maximum at Soultz is shown along a simplified structural cross-section D-D' (data sources: SAEM, PREPA well reports, Sittler '67)

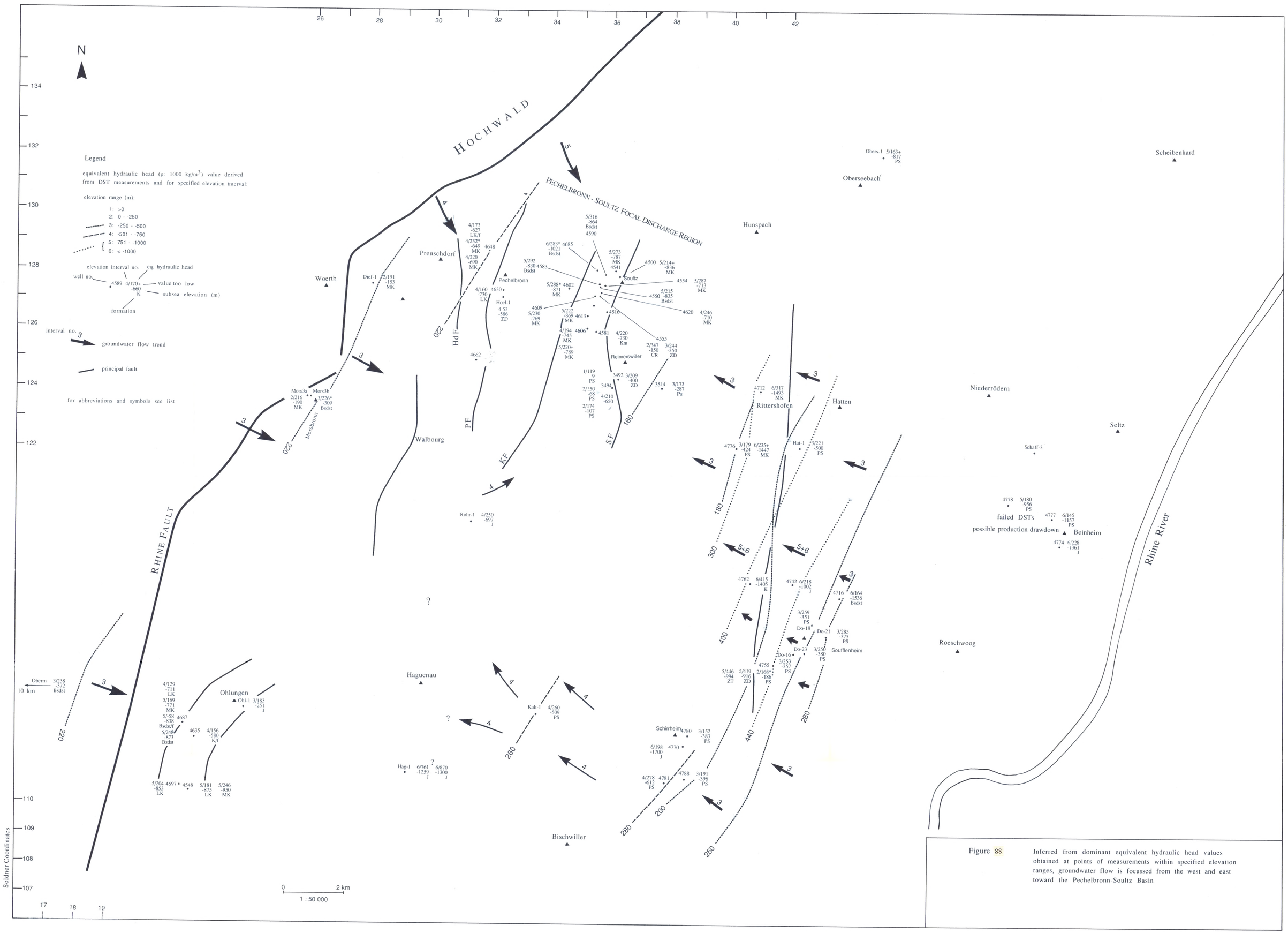


Figure 88 Inferred from dominant equivalent hydraulic head values obtained at points of measurements within specified elevation ranges, groundwater flow is focussed from the west and east toward the Pechelbronn-Soultz Basin

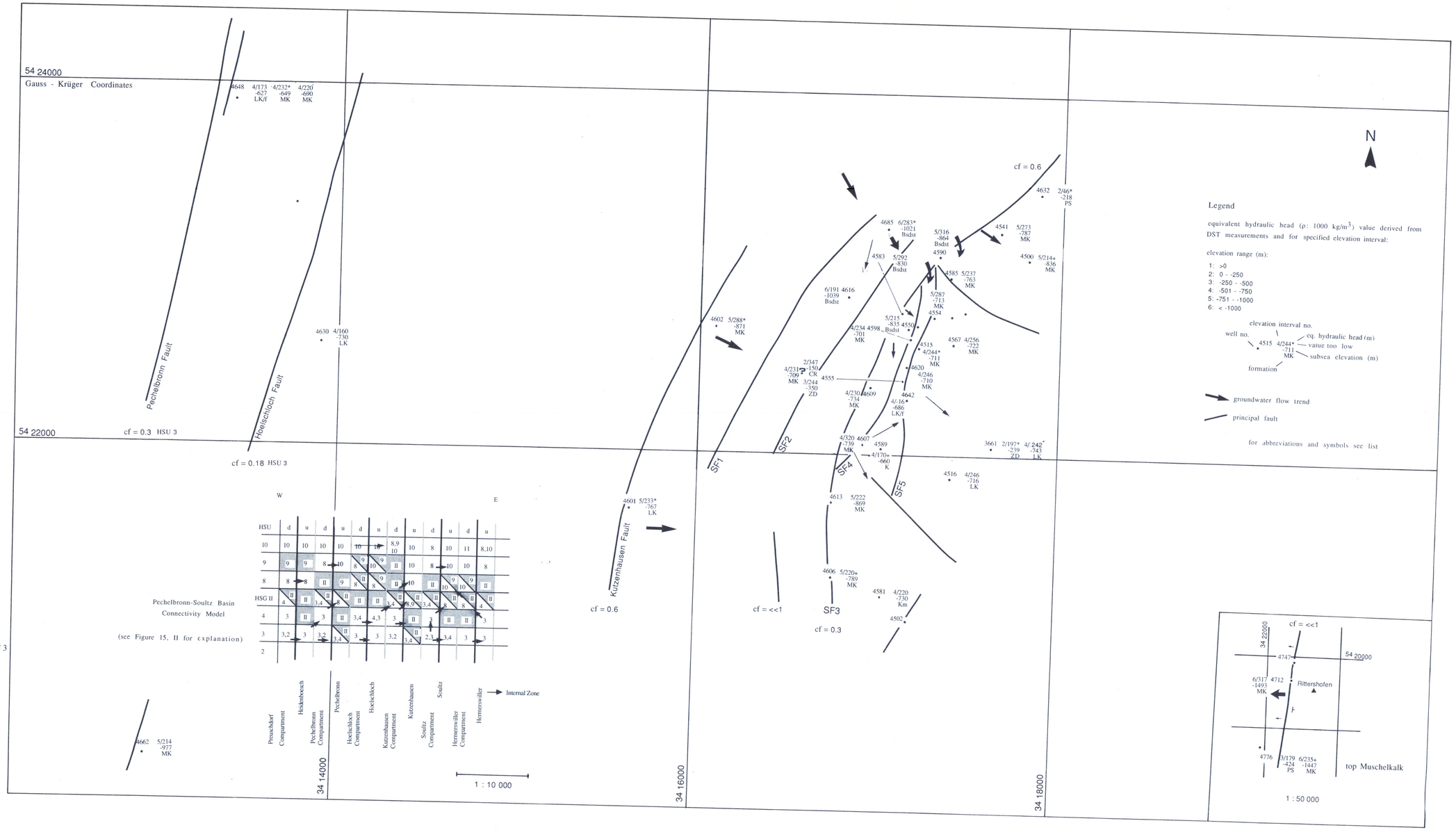


Figure 89

Equivalent hydraulic head values obtained at points of measurements within specified elevation ranges, and inferred groundwater flow trends in HSU 3 at the Kutzenhausen-Soultz region; groundwater directions are dominantly upward along/across fault planes; the connectivity factor indicates that the fault-severd HSU 3 is continuous.

WNW

ESE

Vosges

Hochwald

Lembach Graben

background boreholes

boreholes

Mitschdorf

Preuschdorf projected

Pechelbronn

Kutzenhausen

Seltzbach

marshland phreatophytes

Soultz

Hohwiller

Soultz

Seltzbach

Mattenmühle

RG-1

Rhine Fault

Kinderstoch Fault

Heidenboesch Fault

Pechelbronn Fault

Hoelschloch Fault

Kutzenhausen Fault

Soultz Fault

Hermerswiller Fault

Soultz Fault

Hermerswiller Fault

gypsum

oil fields

oil fields

elevation (m a.s.l.)

temperature at 16 m depth (°C)

water level below land surface (m)

temperature at 16 m depth

mean T = 11.2 °C

water level

specific electrical conductivity (µS/cm at 25 °C)

EC

chloride

strontium

bromide

iodide

lithium

ionic concentration (mg/l)

: artesian flowing well

: rising water level in well

tr: oil traces

*: extrapolated $T_{16\ m}$ value

h : v = 1 : 10

0 1000 2000 m

Figure 90

Shallow-depth chemical and temperature survey along the Pechelbronn-Soultz Basin: data and results on hydrochemistry and temperature (see Figure for well locations)